2017 National Geospatial Data Asset (NGDA) Theme Summary Report
Geodetic Control Theme

Overview:

This report aggregates information related to the National Geospatial Data Asset (NGDA) Theme in the title above. NGDA Themes serve as the management units for collections of related NGDA Datasets that benefit from coordinated development and management across the NGDA national geospatial portfolio. These NGDA Datasets are considered national capital assets and must meet the criteria outlined in OMB Circular A-16 *Supplemental Guidance*. The guidance directs the Federal Geographic Data Committee (FGDC) through cooperation with Federal agencies to implement and use a Portfolio management approach for managing NGDA Themes and their associated NGDA Datasets both within and across NGDA Themes. This ensures NGDA Themes are managed by officially designated agencies, on behalf of all users. In addition, each NGDA Theme has a Strategic Plan that establishes goals and objectives and an associated Implementation Plan that describes the activities the Theme will undertake to address them. Unless otherwise noted, this report covers the period from the baseline Lifecycle Maturity Assessment (LMA) in 2015 to August 2017.

NGDA Theme Details:

Theme: Geodetic Control Theme

Theme Definition: Survey control points or other related datasets which are accurately tied to the National Spatial Reference System, a common system for establishing coordinates for geospatial data that are consistent nationwide. Examples include: (1) benchmarks, (2) triangulation or GPS survey stations (3) data from Global Navigation Satellite Systems (e.g., GPS), (4) gravity measurements, and (5) models of the earth's gravity field (geoid).

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Total Associated NGDA Datasets: 4

The following NGDA Datasets are associated with this NGDA Theme. This list includes an embedded hyperlink to the NGDA metadata found on Data.gov. Please note if the metadata has been updated and re-harvested after publication of this report, the link may no longer be valid. The NGDA Dataset may be searched for manually in Data.gov or GeoPlatform.gov by using the official NGDA Name (in Table 1 below) and including the keyword "NGDA" to narrow the results.

NGDA Name and Associated Data.gov Link	Agency Acronym
Airborne Gravity (GRAV-D)	DOC-NOAA
Continuously Operating Reference Stations (CORS)	DOC-NOAA
Geodetic Control Information on Passive Marks	DOC-NOAA
Geoid Models	DOC-NOAA

Table 1: Theme NGDA Datasets.

Lifecycle Maturity Assessment (LMA) Overview

Introduction

The Geospatial Data Lifecycle has seven stages that agencies should use when developing, managing and reporting on NGDA Datasets. These stages and their associated benchmarks[1] are defined in the A-16 *Supplemental Guidance* Stages of the Geospatial Data Lifecycle (see Figure 1). Reporting on the status of each NGDA Dataset is an OMB requirement, and assessing the developmental maturity of the NGDA provides managers the ability to support NGDA Datasets in a more universal and transparent manner. The FGDC NGDA lifecycle maturity assessment is based on responses made by Dataset Managers to questions associated with benchmarks in each lifecycle stage. Each stage has a range of benchmark activities, from no activity to significant activity, which provide the interpretation of maturity for each benchmark within a stage and cumulatively for each stage. The cumulative level of activity across each stage and for all stages determines the maturity of the each NGDA Dataset based on a Maturity Matrix (see Table 2) and the response metrics from How to Calculate Maturity. In this report, the LMA results for all the associated NGDA Datasets are aggregated through an average calculation at the Theme level. Additional information can be found at the GeoPlatform.gov 2017 Lifecycle Maturity Assessment (LMA) Community web page. Individual NGDA Dataset Reports can be found at FGDC.gov.

Figure 1. The Geospatial Data Lifecycle

[1] Benchmarks are detailed in Table B1 of the Stages of the Geospatial Data Lifecycle document.

2017 Lifecycle Maturity Assessment Maturity Matrix

The Lifecycle Maturity Assessment Maturity Matrix provides descriptions of the maturity characteristics of benchmark activities for each stage within a dataset that result in a maturity level of 0-5, with no activity being level zero and optimized being level five, applied consistently across all lifecycle stages.

Maturity Level	Maturity Characteristics for All Lifecycle Stages
Optimized; Established Level = 5	Dataset meets virtually all business needs of all users. The dataset is considered authoritative by owners and secondary users. It is curated across all stages of the approved lifecycle. Future needs are defined for both the primary owner and secondary users on a regular basis and resources for addressing both current and future business requirements are available.
Mature; Consistent Level = 4	Dataset meets all the business needs of the primary owner and most of the secondary users. The dataset is curated and used as an authoritative resource by the primary owner and secondary users. Future needs are being identified and steps are planned to address these. All stages are supported and reviewed on a recurring basis. The dataset is well managed in relation to the approved lifecycle.
Managed; Predictable Level = 3	Dataset meets a significant number of the business needs of the primary owner and is widely used by secondary users. Benchmark activities are occurring in at least four of the approved lifecycle stages. Management practices in relation to the approved lifecycle is moderate but consistent. Dataset is integrating changing business requirements in lifecycle stages impacting overall maturity.
Transition; Transformation Level = 2	Dataset meets business needs of the primary owner and has moderate use by secondary users. Benchmark activities are occurring in at least three stages. Efforts to integrate funding, include partners, and obtain data are not supported in a sustained manner. Management practices in relation to the stages of the approved lifecycle is limited.
Planned; Initial Development Level = 1	Dataset in initial planning or limited in meeting business needs of the primary owner. Benchmark activities in the approved lifecycle are just starting to consider secondary uses, Partners/stakeholders involvement is being defined and developed to support additional dataset uses. Dataset development is in a very early stage. Minimal or limited management against the benchmarks in the approved lifecycle.
No Activity Level = 0	Dataset not developed or meets project/local business needs of the primary owner. Secondary, additional uses, or partners/stakeholders were not considered. Dataset is not recognized as authoritative data or is part of a similar dataset. Not managed to any of the benchmarks in the approved lifecycle.

Table 2: 2017 Maturity Matrix.

2017 LMA Maturity Results for the Theme

Based on the LMA results, maturity averages are calculated for all NGDA Datasets associated with the Theme to illustrate a roll-up of the general questions for all stages, and each lifecycle stage as shown in Table 3 below. This table provides a high-level view of the aggregated maturity of the NGDA Datasets in the Theme.

Maturity Categories	Maturity Level
Roll-up NGDA Maturity	**5 - Optimized; Established**
General Questions for All Stages	5 - Optimized; Established
Stage 1: Plan/Define	5 - Optimized; Established
Stage 2: Inventory/Evaluate	5 - Optimized; Established
Stage 3: Obtain	5 - Optimized; Established
Stage 4: Access	5 - Optimized; Established
Stage 5: Maintain	5 - Optimized; Established
Stage 6: Use/Evaluate	5 - Optimized; Established
Stage 7: Archive	5 - Optimized; Established

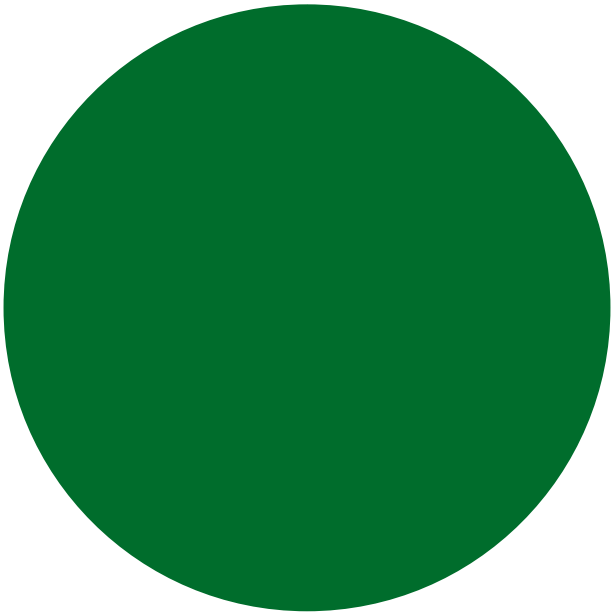
Table 3: 2017 Maturity Results.

LMA Process Changes between 2015 and 2017

In 2015, a baseline assessment of NGDA was performed for each of the datasets in the federal geospatial portfolio. Information related to the 2015 baseline LMA can be found at 2015 NGDA Lifecycle Maturity Assessment, which also includes a link to the 2015 Reports. A follow-up analysis of the 2015 LMA baseline process and its results identified ways to improve the LMA workflow, increase efficiency as well as decrease the reporting burden. Several recommendations were identified and implemented in 2017, which included improvements to normalize the responses in 2017. A secondary effect of improvements to normalization is that results from 2017 and 2015 are not directly comparable. These changes, and their impacts, are detailed in the webpage: Temporal Changes in Lifecycle Maturity Assessment (LMA) Maturity and Results Comparisons.

Aggregated Maturity Level for Theme NGDA Datasets

The pie graph below shows the number of NGDA Datasets within each maturity level for this Theme.



4

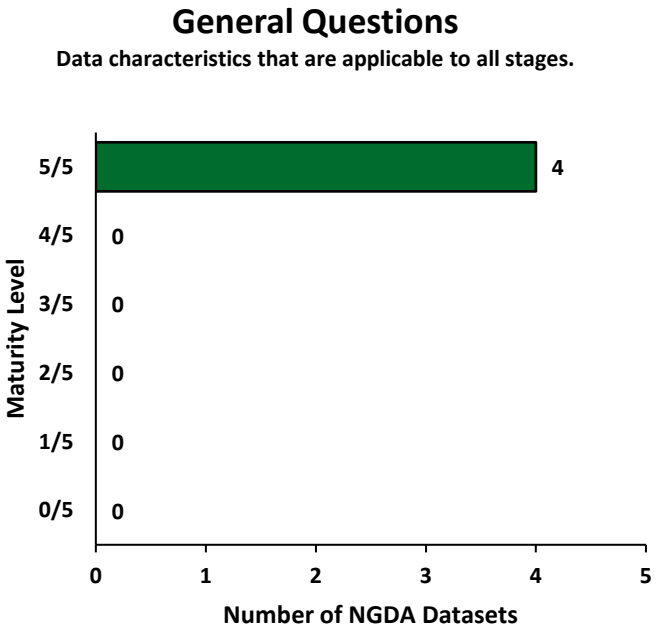
Graph 1: Aggregated NGDA Dataset Maturity Level Counts in the Theme.

Key for NGDA Dataset Maturity Level:

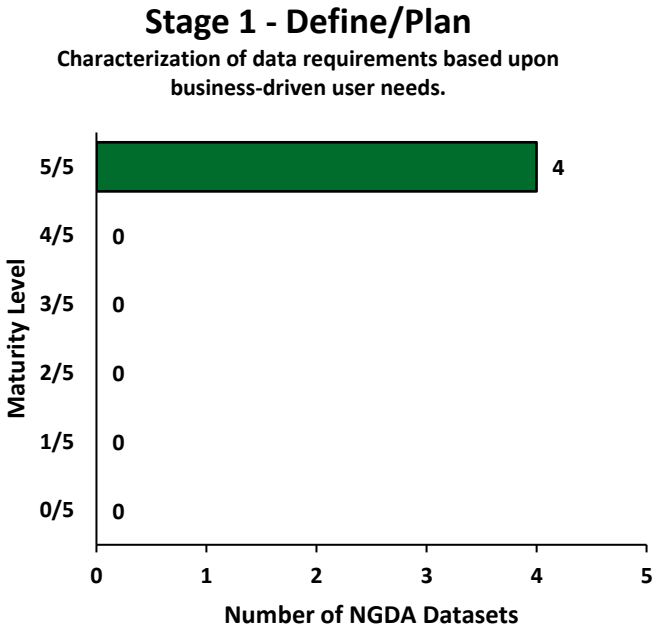
Optimized; Established Level = 5 5/5	Mature; Consistent Level = 4 4/5	Managed; Predictable Level = 3 3/5	Transition; Transformation Level = 2 2/5	Planned; Initial Development Level = 1 1/5	No Activity Level = 0 0/5

Stage-based Maturity Levels for Theme NGDA Datasets

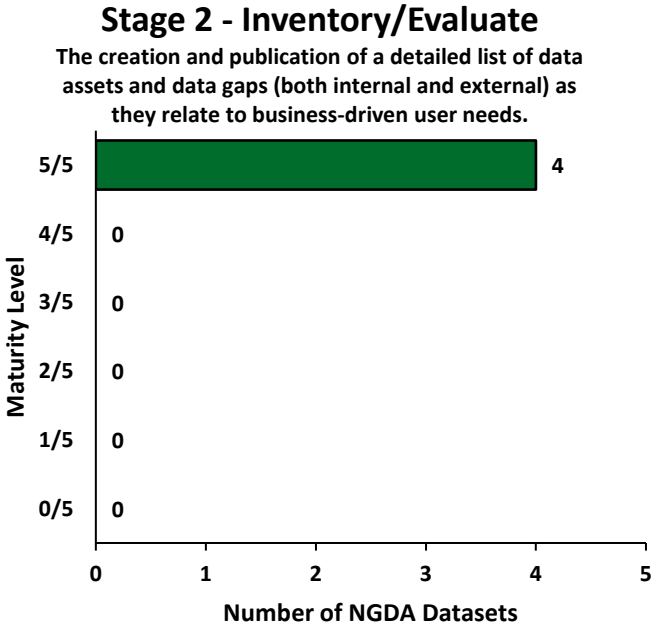
The following graphs provide information about the NGDA Dataset maturity level counts for each lifecycle stage within the Theme. This information visualizes the NGDA Datasets according to the maturity matrix, which can show potential opportunities or challenges within a Theme.



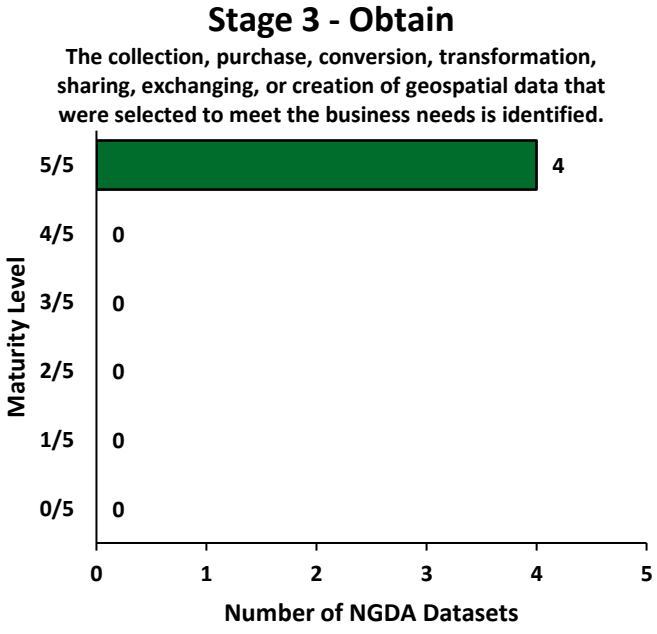
Graph 2: General Questions Stage NGDA Maturity Level Counts.



Graph 3: Define/Plan Stage NGDA Maturity Level Counts.



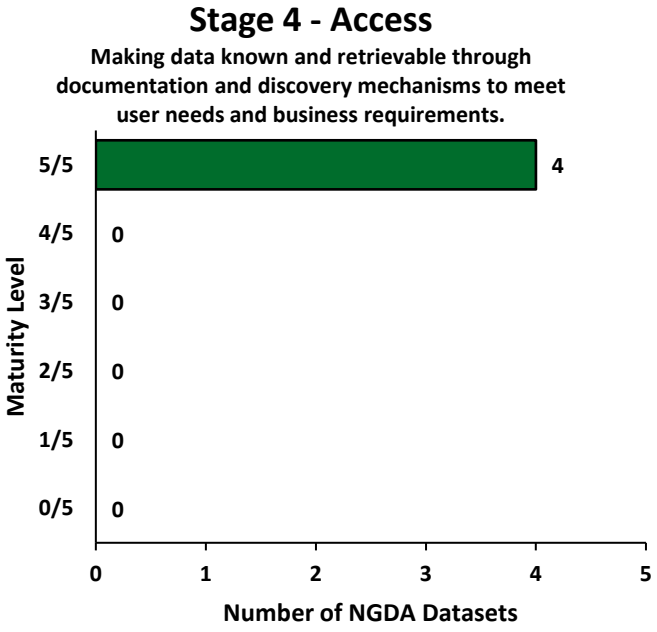
Graph 4: Inventory/Evaluate Stage NGDA Maturity Level Counts.



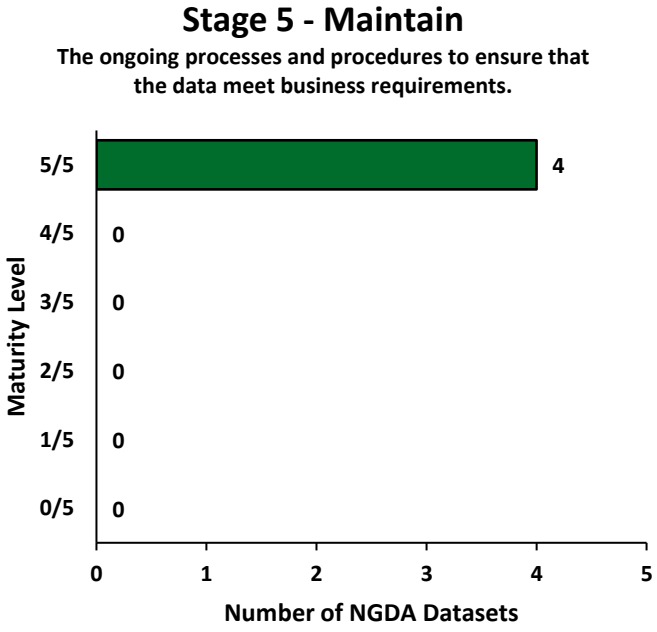
Graph 5: Obtain Stage NGDA Maturity Level Counts.

Key for NGDA Dataset Maturity Level:

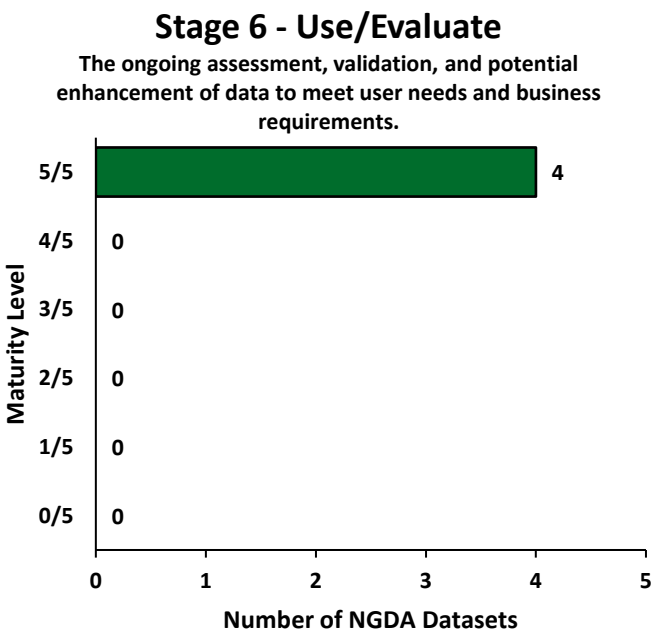
Optimized; Established Level = 5 5/5	Mature; Consistent Level = 4 4/5	Managed; Predictable Level = 3 3/5	Transition; Transformation Level = 2 2/5	Planned; Initial Development Level = 1 1/5	No Activity Level = 0 0/5



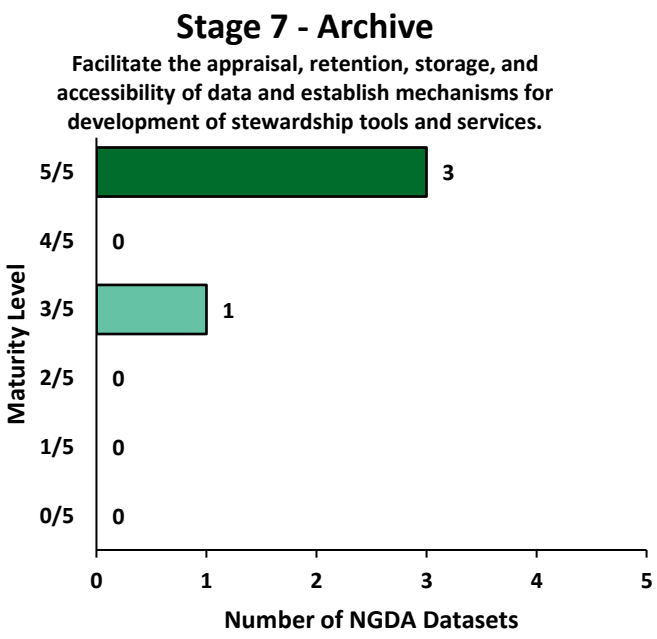
Graph 6: Access Stage NGDA Maturity Level Counts.



Graph 7: Maintain Stage NGDA Maturity Level Counts.



Graph 8: Use/Evaluate Stage NGDA Maturity Level Counts.



Graph 9: Archive Stage NGDA Maturity Level Counts.

Key for NGDA Dataset Maturity Level:

Optimized; Established Level = 5 5/5	Mature; Consistent Level = 4 4/5	Managed; Predictable Level = 3 3/5	Transition; Transformation Level = 2 2/5	Planned; Initial Development Level = 1 1/5	No Activity Level = 0 0/5

Theme NGDA Dataset Maturity Levels for Selected LMA Questions

In this section, several LMA questions have been identified that provide additional insight into Theme NGDA Dataset maturity levels including funding, obtaining data (acquisition), and quality control/quality assurance. By separating these questions from a particular stage, more information can be discerned about the NGDA Datasets within a Theme and help identify activities that are doing well or where some additional attention may be needed. For each of these maturity questions, if the "0/5" (No process exists) option was selected, additional detail was requested. Optional information could also be provided for the supplemental justification questions under the "Other" response option.

Funding

Question 1 in the LMA asks about a process to obtain funding for all lifecycle stages such as planning, development, maintenance, access, and archiving of an NGDA Dataset. The question also provides additional detail about primary and secondary funding sources.

Question 1		General Questions
Is there a recurring process to obtain funding for all lifecycle stages of this dataset?		
Maturity Level	**Number of Responses**	**Response Options**
5/5	4	Funding support is part of agency budget on a recurring basis, funding is consistent and tied to business requirements, and supports all lifecycle stages
4/5	0	Funding is currently adequate and consistent but tied to business requirements whose appropriations are not directed to support all lifecycle stages of the NGDA
3/5	0	Funding support exists but is not adequate to meet known requirements, most lifecycle stages are supported
2/5	0	Funding is planned at agency level, supporting staff is assigned, but funding is not recurring, some lifecycle stages are supported
1/5	0	Funding is from local offices, budgeting effort is minimal, staffing is minimal
0/5	0	No process to obtain funding exists (Please explain)

Table 4: NGDA Maturity Level Totals for Funding.

Question 1.a	General Questions
1.a) To justify your response to Question 1, what is the primary funding source for your NGDA?	
Number of Responses	**Response Options**
1	**Directed appropriation(s) –** Funding signed into law by Congress for a specific program that supports this NGDA or the NGDA itself.
3	**Federal agency –** General lead agency budgetary funding for a specific program that supports this NGDA or the NGDA itself.

Table 5: Primary Funding Source for NGDA Datasets in Theme.

Obtaining Data

Question 10 in the LMA identifies whether a process exists for obtaining data related to the NGDA and if so, what actions are performed to obtain data. There may be multiple ways data is obtained for an NGDA Dataset.

Question 10		Stage 3 - Obtain
Is there a process for obtaining data for this dataset?		
Maturity Level	**Number of Responses**	**Response Options**
5/5	4	Fully implemented including recurring assessments
4/5	0	Implementation well established
3/5	0	Implementation progressing
2/5	0	Developed, documented, and implementation started
1/5	0	Under development
0/5	0	No process exists

Table 6: NGDA Maturity Level Totals for Obtaining Data.

Question 10.a	Stage 3 - Obtain
10.a) To justify your response to Question 10, what actions are performed to obtain data?	
Number of Responses	**Response Options**
1	Obtain data by purchasing
1	Obtain data by modifying, converting, or transforming data
2	Obtain data by sharing/exchanging
4	Obtain data by creating and/or collecting the data
1	Other – (Please explain) • Established dataset derived from cooperative endeavor involving government, academic, and private organizations

Table 7: Actions Performed to Obtain Data for NGDA Datasets in Theme.

Quality Assurance/Quality Control (QA/QC)

Question 15 in the LMA asks whether a process for quality assurance/quality control exists and the level of maturity of the process.

Question 15		Stage 5 - Maintain
Is there a quality assurance/quality control (QA/QC) process as part of this dataset's maintenance?		
Maturity Level	**Number of Responses**	**Response Options**
5/5	4	Fully implemented including recurring assessments
4/5	0	Implementation well established
3/5	0	Implementation progressing
2/5	0	Developed, documented, and implementation started
1/5	0	Under development
0/5	0	No process exists

Table 8: NGDA Maturity Level Totals for Quality Assurance/Quality Control Process.

Geodetic Control Theme Strategic Goals and Objectives Progress Report

Introduction and Background

Each NGDA Theme has a Theme Strategic Plan to guide Theme development and management. It is developed by the Federal agencies with Theme leadership roles. Each Theme Strategic Plan describes the goals and objectives for the Theme and generally spans 3 to 5 years. It is assessed annually as needed for significant changes. In 2016-2017, the FGDC Steering Committee identified the additional priority for each Theme to develop a Theme Implementation Plan that identifies the actions and activities necessary to achieve the Theme's goals and objectives. The NGDA Themes' Strategic and associated Implementation Plans are available in Adobe PDF format via the respective Geoplatform.gov NGDA Theme Community pages (see Resource Links below).

Resource Links

Theme Strategic Plan: Geodetic Control Theme Strategic Plan

Theme Implementation Plan: Geodetic Control Theme Implementation Plan

Progress in 2017

As noted above, Theme Strategic Plans identify goals and objectives for the Theme as they relate to Agency Strategic Plans. The Theme Implementation Plans further identify actions and activities that will be taken to support those goals and objectives. The Implementation Plans also include milestones, projected completion dates and performance indicators, and identify stakeholders and responsible parties. A summary of progress against the Theme Strategic Plan goals and objectives is provided as part of this overall Theme Summary Report. The following table shows the progress status made toward achieving the objectives during 2017. Status includes three categories: 'Not Started' for those activities that have not gotten underway; 'In Progress' for those activities underway which will continue into the next year; 'Complete' for the activities finished in this time frame. Additionally, if activities supporting the goal and objective are completed in the current year and will reoccur again on an annual basis, they are designated 'Recurring (completed for 2017)'.

Goals and Objectives undertaken during 2017	Status
Continuously Operating Reference Stations (CORS) Goal 1: Maintain current density of CORS sites and ensure accuracy of metadata with station owners and operators, while ensuring the network is expanded where needed and refined to better tie into the International Terrestrial Reference Frame (ITRF).	
Objective 1. The primary objective of CORS is to define, maintain and provide access to the geometric component (Latitude, Longitude, Ellipsoid Heights) of the National Spatial Reference System (NSRS). Since 95% of the stations in the CORS network are independently owned and operated, it is essential that the site owners maintain their stations. Sharing equipment changes with NGS is important because antenna changes and cables or receiver changes can result in coordinate changes which then impact all users of the data.	Recurring – complete for 2017
Objective 2. In order to better support international activities in global reference frame realization, NGS plans to build and expand foundational GNSS tracking station network with higher standards. These Foundation CORS (FCORS) sites will improve the NSRS with stronger ties to the International Terrestrial Reference Frame (ITRF). In turn, these stronger ties will better constrain future positions of all other CORS and thereby improve positional accuracy of our products to users in the field.	Recurring – complete for 2017
Continuously Operating Reference Stations (CORS) Goal 2: Encourage continued upgrade of equipment to include additional GNSS constellations beyond GPS.	
Objective 1. The CORS network requires GPS signals to be tracked by all station operators. With the increasing availability of additional GNSS constellations, supporting these new/newer signals is becoming more important.	Recurring – complete for 2017
Airborne Gravity (GRAV-D) Goal 1: Define, maintain, and provide access to the National Spatial Reference System (NSRS), specifically for gravity data throughout the United States and its territories. Gravity data are collected, processed and archived in order to provide access via online tools for a number of applications that require knowledge of the local gravity field. Gravity data also used in formation of geoid height models that provide a transformation model between GPS-derived ellipsoid heights and heights above the vertical datum. Accurate heights are critical to many industries, including floodplain definition and management, levee construction and maintenance, transportation and infrastructure development, and coastal management. See the NGDA Geoid Data set for further details.	
Objective 1. Collect and process high quality airborne gravity data for the entire U.S. and territories by 2022 to support modeling of the Earth's geoid, which will serve as a zero reference surface for all heights in the nation. This objective is under the Gravity for the Redefinition of the American Vertical Datum (GRAV-D) program.	Recurring – 64% complete for 2017 (on track for 2022)
Objective 2. Develop a plan to monitor the gravity field over time for changes that affect the geoid more than 1 centimeter. This objective is under the Gravity for the Redefinition of the American Vertical Datum (GRAV-D) program.	In Progress

Geodetic Control Information on Passive Marks Goal 1: Support and modernize the National Spatial Reference System (NSRS) in the development and maintenance of passive control to ensure alignment with the mission of the National Geodetic Survey (NGS). Major parts of the NGS Ten Year Strategic Plan (2013-2023) focus on the need to maintain access to passive control under the current realization of datums. It also stresses the need to align passive control with the future datum realizations, and improve toolkit.	
Objective 1. Maintain and support the capability to ingest, analyze, store, and disseminate internal and external survey data in the form of Bluebooking, datasheets and associated products and services.	Recurring – complete for 2017
Objective 2. Modernize and improve NSRS.	Recurring – complete for 2017 (on track for 2022)
Objective 3. Evaluate and improve the Toolkit.	Recurring – complete for 2017 (on track for 2022)
Geoid Models Goal 1: Define, maintain, and provide access to the National Spatial Reference System (NSRS), specifically for access to the current vertical datum of the United States and its territories (e.g., NAVD 88). Vertical datums are traditionally realized through a network of vertical control bench marks, which requires field crews to level between them and target areas of interest. Instead, NGS develops so-called "hybrid" geoid height models to facilitate the use of determining vertical control heights through GNSS observations. This process is much more efficient and cost saving than the traditional leveling.	
Objective 1. Hybrid geoid models are developed using geodetic control data (available as a separate NGDA data set) in combination with gravity data (another NGDA gravity data set). Because both the other NGDA data sets are continuously being updated, it necessary on an infrequent basis to determine new hybrid geoid models to be consistent with these changes. The current model is GEOID12B. It may be necessary to develop another model in 2019 (possibly GEOID19). After 2022, vertical datums for all US areas will be defined strictly by a geopotential datum defined solely by gravity data.	In Progress – none scheduled for 2017 but a model is under consideration for 2019
Geoid Models Goal 2: NGS models the Earth's static gravity field and the geoid, which will serve as a zero surface for all heights in the nation. By 2022, the orthometric heights in the geopotential reference frame will be determined to an accuracy of 2 centimeters when using 15 minutes of GNSS data.	
Objective 1. Research and develop theory, computation methods, and procedures for the determination of the Earth's gravity field and the geoid for North America and the US territories. Gravimetric geoid models provide an equipotential surface determined gravimetrically using satellite gravity models, GRAV-D airborne and terrestrial gravity data. While the GRAV-D project is in progress, experimental geoid (xGEOID) models have been computed annually using available GRAV-D data since 2014. The xGEOID models will converge to the final geoid model for the geospatial reference system in 2022.	Completed (xGEOID17)

Table 9: 2017 Progress Summary for Theme Strategic Plan Goals and Objectives.